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Indian Standard
REFERENCE ZERO FOR THE CALIBRATION OF PURE TONE AIR CONDUCTION AUDIOMETERS
(First Revision)

First Reprint FEBRUARY 2001

UDC 534.773.2.089.6 : 616.28-76

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 2 *February* 1988

AMENDMENT NO. 1 NOVEMBER 2000
TO
IS 4755 : 1987 REFERENCE ZERO FOR THE CALIBRATION OF PURE TONE AIR CONDUCTION AUDIOMETERS

(First Revision)

(*Page* 3, *clause* **0.3**) — Substitute the following for the existing text:

'This standard states the information in a form suitable for direct application to the calibration of audiometers, that is, in terms of the response of six different standard types of earphone measure on a coupler in accordance with IS 10779 : 1984 or an artificial ear as specified in IEC 318.'

(*Page* 3, *clause* **0.5**) — Substitute the following for the existing text:

'While preparing this standard, assistance has been derived from ISO 389 : 1991, issued by the International Organization for Standardization (ISO), and ANSI S3.6 : 1989, issued by the American National Standards Institution (ANSI).'

(*Page* 5, *clause* **2.7**) — Substitute the existing Note with the following:

'NOTE — The relation between hearing threshold levels for air conduction and age is specified in Annex A of IS 7197 : 1994.'

(*Page* 5, *clause* **2.9**) — Delete the Note.

(*Page* 5, *clause* **3.2**) — Substitute the first sentence with the following:

'The recommended standard values for different earphones are given in Table 1.'

(*Page* 6, *Table* 1) — Substitute the following table with the existing:

Table 1 Recommended Reference Equivalent Threshold Sound Pressure Levels

(Measured data values rounded off to the nearest half decibel)

(*Clause* 3.2)

Frequency Hz	RETSPL (Reference : 20 μ Pa) dB		
(1)	(2)	(3)	(4)
125	45.0	47.0	47.5
250	25.5	27.4	26.5
500	11.5	13.1	13.5
750	—	8.4	8.5
1 000	7.0	6.5	7.5
1 500	6.5	5.1	7.5
2 000	9.0	8.1	11.0
3 000	10.0	7.5	9.5
4 000	9.5	8.7	10.5
6 000	15.5	17.4	13.5
8 000	13.0	17.6	13.0
Pattern of earphone (*see* Note 1)	Telephonics TDH39 with MX41/AR	Telex 1470A earphones	TDH50 / TDH50P TDH49 / TDH49P

NOTES

1 Earphones shall be used with their ear-cushions both on the human ear and on the coupler.

2 Columns (2), (3), and (4) specify the sound pressure level in a coupler in accordance with IS 10779 : 1984

(LTD 5)

Printed at New India Printing Press Khurja, India

Indian Standard

REFERENCE ZERO FOR THE CALIBRATION OF PURE TONE AIR CONDUCTION AUDIOMETERS

(First Revision)

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Indian Standard

REFERENCE ZERO FOR THE CALIBRATION OF PURE TONE AIR CONDUCTION AUDIOMETERS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards on 23 September 1987, after the draft finalized by the Acoustics Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 This standard was originally published in 1968. Consequent to the revision of ISO 389 'Standard reference zero for the calibration of pure-tone audiometers' on which this standard was based, it has been revised to bring it in line with the latest ISO publication.

0.3 This standard states the information in a form suitable for direct application to the calibration of audiometers, that is, in terms of the response of two different standard types of earphone measure on a coupler in accordance with IS : 10779-1984*.

0.4 This standard is based on an assessment of the information available from various standardizing laboratories responsible for audiometric standards and from scientific publications. Some notes on derivation and application of the recommended reference levels are given in Appendix A.

0.5 While preparing this standard, assistance has been derived from ISO 389-1985 'Acoustics — Standard reference zero for the calibration of pure tone air conduction audiometers', issued by the International Organization for Standardization (ISO).

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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*Provisional reference coupler for the calibration of earphones used in audiometry.

†Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard specifies a standard reference zero for the scale of hearing threshold level applicable to pure tone air conduction audiometers in order to promote agreement and uniformity in the expression of hearing threshold level measurement throughout the world.

2. DEFINITIONS

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Air Conduction — Transmission of sound through external and middle ear to the inner ear.

2.2 Acoustic Coupler — A cavity of specified shape and volume which is used for the calibration of a supra-aural earphone in conjunction with a calibrated microphone to measure the sound pressure developed within the cavity.

Note — An acoustic coupler is specified in IS : 10779-1984*.

2.3 Artificial Ear — A device for the calibration of an earphone which presents to the earphone an acoustic impedance equivalent to the impedance presented by the average human ear. It is equipped with a calibrated microphone for measurement of the sound pressure developed by the earphone.

Note — Standard on artificial ear is under preparation.

2.4 Threshold of Hearing — The level of sound at which, under specified conditions, a person gives 50 percent of correct detection responses on repeated trials.

2.5 Otologically Normal Person — A person in a normal state of health who is free from all signs or symptoms of ear disease and from obstructing wax in the ear canal, and who has no history of undue exposure to noise.

2.6 Equivalent Threshold Sound Pressure Level (Monaural Earphone Listening) — For a given ear, at a specified frequency, for a specified type of earphone and for a stated force of application of the earphone to the human ear, the sound pressure level set up by the earphone in a specified acoustic coupler or artificial ear when the earphone is actuated by that voltage which, with the earphone applied to the ear concerned, would correspond to the threshold of hearing.

---

*Provisional reference coupler for the calibration of earphones used in audiometry.

2.7 Reference Equivalent Threshold Sound Pressure Level (RETSPL) — At a specified frequency, the modal value of the equivalent threshold sound pressure levels of a sufficiently large number of ears of otologically normal persons, of both sexes, aged between 18 and 30 years inclusive, expressing the threshold of hearing in a specified acoustic coupler or artificial ear for a specified type of a earphone.

NOTE — The relation between hearing threshold levels for air conduction and age is specified in 'Indian Standard on Threshold of hearing by air conduction as a function of age and sex for otologically normal person (*under preparation*)'.

2.8 Hearing Level (of a Pure Tone) — At a specified frequency, for a specified type of earphone and for a specified manner of application, the sound pressure level of this pure tone produced by the earphone in a specified acoustic coupler or artificial ear minus the appropriate reference equivalent threshold sound pressure level.

2.9 Hearing Threshold Level (of a Given Ear) — At a specified frequency and for a specified type of transducer, the threshold of hearing expressed as hearing level.

NOTE — For examples of appropriate test conditions, *see* Indian Standards:

a) Pure tone air conduction threshold audiometry for hearing conservation purposes (*under preparation*), and

b) Pure tone audiometric test methods (*under preparation*).

3. SPECIFICATION

3.1 The reference equivalent threshold sound pressure levels (RETSPLs) are dependent on the pattern of earphone and on the pattern of acoustic coupler used to calibrate it.

3.2 The recommended standard values for two different earphones in a coupler in accordance with IS : 10779-1984* are given in Table 1.

The earphone shall be applied to the coupler without acoustic leakage with a nominal static force of 4·5 ± 0·5 N, not including the weight of the earphone itself.

---

*Provisional reference coupler for the calibration of earphones used in audiometry.

TABLE 1 RECOMMENDED REFERENCE EQUIVALENT THRESHOLD SOUND PRESSURE LEVELS IN A COUPLER IN ACCORDANCE WITH IS : 10779-1984[*]

(Measured data values rounded to the nearest half decibel)

(*Clause* 3.2)

FREQUENCY Hz	RETSPL (Reference: 20µPa) dB		
(1)	(2)	(3)	(4)
125	47·5	45·0	47·0
250	28·5	25·5	27·4
500	14·5	11·5	13·1
750	—	—	8·4
1 000	8·0	7·0	6·5
1 500	7·5	6·5	5·1
2 000	8·0	9·0	8·1
3 000	6·0	10·0	7·5
4 000	5·5	9·5	8·7
6 000	8·0	15·5	17·4
8 000	14·5	13·0	17·6
Pattern of earphone (*See* Note 1)	Beyer DT48 with flat cushion	Telephonics TDH39 with MX41/AR cushion (*See* Note 2)	Telex 1470A earphones

NOTE 1 — TDH39 earphones, with their ear-cushions, should be placed both on the ear and on the coupler, when calibrating the Beyer DT48 earphone; the cushion should, however, be removed and an adaptor used

NOTE 2 — In 1963, the filter cloth in the Telephonics TDH39 earphone was changed, but matched to produce the same earphone response on the 9A coupler. During the change, about 1 000 units were produced with an unmatched cloth The data given in this standard is from several earphones manufactured both before and after 1963.

[*] Specification for provisional reference coupler for the calibration of earphones used in audiometry

APPENDIX A

(*Clause* 0.4)

NOTES ON DERIVATION AND APPLICATION OF RECOMMENDED REFERENCE LEVELS

(This Appendix does not form an integral part of the standard)

A-1. DERIVATION

It is very important to note that the RETSPLs given in the table refer, as closely as can be ascertained from existing data, to the same hearing threshold levels. The differences between the values are mainly due to differences between the acoustical properties of the coupler used and those of the average human ear.

The RETSPLs given in the table for the Beyer DT48 correspond to an average of 15 determinations published, or otherwise communicated to the International Organization for Standardization, during the period from 1950 to 1961. The values have been determined by a cooperative investigation carried out by the following five standardizing laboratories:

Centre National d 'Etudes des Telecommunications, Palaiseau, France;

Physikalisch — Technische Bundesanstalt, Braunschweig, Germany, F.R.;

National Physical Laboratory, Teddington, United Kingdom;

National Bureau of Standards, Washington, USA;

V.N.I.I.M. Laboratory, Leningrad, USSR.

The RETSPLs given in the table for the Telephonics TDH 39 were derived at a later date by subjective loudness balancing methods.

A-2. APPLICATION

A-2.1 As regards the calibration of audiometers which are fitted with earphones of one of the patterns considered in the table, measurements of the acoustical output, using the specified type of coupler, suffice to calibrate the audiometer in terms of the recommended RETSPLs given in the appropriate column in the table. When the earphone is applied to the human ear, the headband used should provide a nominal static force of 4·5 ± 0·5 N.

NOTE — A headband providing a force of 4·5 N for a mean head width of 145 mm will usually comply with this tolerance for adult test population.

A-2.2 In the case of audiometers fitted with earphones of patterns neither mentioned in the table nor specified in this standard, it is necessary first to determine the corresponding RETSPLs for this pattern of earphone. This would normally be done by comparing the earphone subjectively with an earphone of one of the patterns considered in the table, using a suitable 'equal-loudness balance' or 'threshold balance' technique. In certain cases, the results of such comparisons may already be available. For details of technical procedures and facilities for such work, reference should be made to the manufacturer or direct to the appropriate standardizing laboratory.

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